APPENDIX A
(Clean Copy of Claims as Amended)

Claim 1 (currently amended): A method of controlling generated torques of respective torque generation means in a leg body exercise assistive apparatus, which includes a pair of leg sections, each to be attached to a different one of a person's legs so as to be movable integrally with the person's legs, with each of the leg sections having:

a foot orthosis portion for supporting a bottom side of a foot of the person to whom the leg sections are to be attached,

joint regions corresponding to an ankle joint, a knee joint, and a hip joint of each leg of the person to whom the leg sections are to be attached,

link members for attaching the foot orthosis portion and the joint regions to the person's legs, and

torque generation means capable of generating a support torque applied to at least the joint regions corresponding to the knee joint and the hip joint of the person's legs to which the leg sections are to be attached,

the method comprising:

a moment estimation step comprising:

sequentially estimating person-side joint moments when the person wearing the leg body exercise assistive apparatus is moving the person's legs, which includes as components thereof moments to be generated at least in the knee joint and the hip joint of each leg, on the assumption that the person is making almost the same motion as the motion of the legs with the leg body exercise assistive apparatus removed from the person, and

sequentially estimating apparatus-side joint moments, which includes as components thereof moments to be generated in the joint regions of the leg body exercise assistive apparatus

corresponding to at least the knee joint and the hip joint of each leg, respectively, on the assumption that the leg body exercise assistive apparatus is independently making almost the same motion as the motion of the person's legs without being attached to the person; and

a torque control step comprising controlling the torque generation means so as to generate a support torque, which is obtained by adding a torque determined according to the estimated value of the person-side joint moment corresponding to the joint region concerned to a respective reference torque, on the assumption that the estimated value of the apparatus-side joint moment of each joint region corresponding to each of the knee joint and the hip joint of the leg is the reference torque to be generated by the torque generation means corresponding to the joint region concerned.

Claim 2 (currently amended): A method of controlling generated torques of respective torque generation means in a leg body exercise assistive apparatus, which includes a pair of leg sections, each to be attached to a different one of a person's legs so as to be movable integrally with the person's legs, with each of the leg sections having:

a foot orthosis portion for supporting a bottom side of a foot of the person to whom the leg sections are to be attached

joint regions corresponding to an ankle joint, a knee joint, and a hip joint of each leg of the person to whom the leg sections are to be attached,

link members for attaching the foot orthosis portion and the joint regions to the person's legs, and

the torque generation means capable of generating a support torque applied to the joint regions corresponding to the ankle joint, the knee joint, and

the hip joint of the person's legs to which the leg sections are to be attached,

the method comprising:

a moment estimation step comprising:

sequentially estimating person-side joint moments when the person wearing the leg body exercise assistive apparatus is moving the person's legs, which includes as components thereof moments to be generated at least in the knee joint, the hip joint, and the ankle joint of each leg, on the assumption that the person is making almost the same motion as the motion of the legs with the leg body exercise assistive apparatus removed from the person, and

sequentially estimating apparatus-side joint moments, which includes as components thereof moments to be generated in the joint regions of the leg body exercise assistive apparatus corresponding to the knee joint, the hip joint, and the ankle joint of each leg, respectively, on the assumption that the leg body exercise assistive apparatus is independently making almost the same motion as the motion of the person's legs without being attached to the person; and

a torque control step comprising controlling the torque generation means so as to generate a support torque, which is obtained by adding a torque determined according to the estimated value of the person-side joint moment corresponding to the joint region concerned to a respective reference torque, on the assumption that the estimated value of the apparatus-side joint moment of each joint region corresponding to each of the ankle joint, the knee joint, and the hip joint is the reference

torque to be generated by the torque generation means corresponding to the joint region concerned.

Claim 3 (currently amended): The generated torque control method for a leg body exercise assistive apparatus according to claim 1, wherein the person-side joint moment and the apparatus-side joint moment estimated in the moment estimation step are moments around an axis substantially perpendicular to a leg plane defined as a plane passing through the hip joint, the knee joint, and the ankle joint of each leg of the person.

Claim 4 (currently amended): The generated torque control method for a leg body exercise assistive apparatus according to claim 1, wherein the moment estimation step includes: a first step of sequentially grasping an acceleration of a predetermined region of the person or the leg body exercise assistive apparatus; a second step of sequentially grasping displacements of the hip joint, the knee joint, and the ankle joint of each leg of the person; a third step of sequentially estimating floor reaction forces acting on the person and the application point thereof, on the assumption that almost the same motion as the motion of both legs of the person is being made with the leg body exercise assistive apparatus removed from the person; a fourth step of sequentially estimating floor reaction forces acting on the leg body exercise assistive apparatus and the application point thereof, on the assumption that the leg body exercise assistive apparatus is independently making almost the same motion as the motion of both legs of the person without being attached to the person; a fifth step of estimating the person-side joint moment by inverse dynamics calculation processing by using the acceleration grasped in the first step, the displacements grasped in the second step, the floor reaction forces and the application point thereof estimated in the third step, and a person-side rigid link model which represents the person as a link body formed of a plurality of rigid

elements and joint elements; and a sixth step of estimating the apparatus-side joint moment by inverse dynamics calculation processing by using the acceleration grasped in the first step, the displacements grasped in the second step, the floor reaction forces and the application point thereof estimated in the fourth step, and an apparatus-side rigid link model which represents the leg body exercise assistive apparatus as a link body formed of a plurality of rigid elements and joint elements.

Claim 5 (currently amended): The generated torque control method for a leg body exercise assistive apparatus according to claim 4, wherein:

the person-side joint moment estimated in the fifth step and the apparatus-side joint moment estimated in the sixth step are moments around an axis substantially perpendicular to a leg plane defined as a plane passing through the hip joint, the knee joint, and the ankle joint of each leg of the person; and

the acceleration grasped in the first step, the floor reaction forces and the application point thereof estimated in the third step, and the floor reaction forces and the application point thereof estimated in the fourth step are all three-dimensional quantities,

the displacements of the hip joint, the knee joint, and the ankle joint of each leg grasped in the second step each include an amount of rotation around an axis substantially perpendicular to the leg plane of the leg and the displacement of the hip joint is a three-dimensional quantity,

the generated torque control method further comprising:

a seventh step of sequentially grasping an acceleration of a predetermined reference point fixed to a person's predetermined region as a three-dimensional quantity by using at least the acceleration grasped in the first step;

an eighth step of sequentially grasping the positions and postures on the leg plane of the elements of each leg section of the person-side rigid link model by using

at least the displacements grasped in the second step and the person-side rigid link model;

a ninth step of grasping the positions and postures on the leg plane of the elements of each leg section of the apparatus-side rigid link model by using at least the displacements grasped in the second step and the apparatus-side rigid link model, wherein:

the fifth step includes estimating the person-side joint moment by using a two-dimensional quantity, which is obtained by projecting the acceleration of the predetermined reference point grasped in the seventh step and the floor reaction forces and the application point thereof estimated in the third step onto the leg plane corresponding to each leg according to the displacement of the hip joint, and the positions and postures grasped in the eighth step; and

the sixth step includes estimating the apparatus-side joint moment by using a two-dimensional quantity, which is obtained by projecting the acceleration of the predetermined reference point grasped in the seventh step and the floor reaction forces and the application point thereof estimated in the fourth step onto the leg plane corresponding to each leg according to the displacement of the hip joint, and the positions and postures grasped in the ninth step.

Claim 6 (original): The generated torque control method for a leg body exercise assistive apparatus according to claim 4, wherein the third step includes estimating the floor reaction forces acting on the person and the application point thereof by using at least the acceleration grasped in the first step, the displacements grasped in the second step, and the person-side rigid link model and the fourth step includes estimating the floor reaction forces acting on the leg body exercise assistive apparatus and the application point thereof by using at least the acceleration grasped in the first step, the displacements grasped in the second step, and the apparatus-side rigid link model.

Claim 7 (original): The generated torque control method for a leg body exercise assistive apparatus according to claim 5, wherein the third step includes estimating the floor reaction forces acting on the person and the application point thereof by using at least the acceleration grasped in the first step, the displacements grasped in the second step, and the person-side rigid link model and the fourth step includes estimating the floor reaction forces acting on the leg body exercise assistive apparatus and the application point thereof by using at least the acceleration grasped in the first step, the displacements grasped in the second step, and the apparatus-side rigid link model.

Claim 8 (currently amended): The generated torque control method for a leg body exercise assistive apparatus according to claim 2, wherein the person-side joint moment and the apparatus-side joint moment estimated in the moment estimation step are moments around an axis substantially perpendicular to a leg plane defined as a plane passing through the hip joint, the knee joint, and the ankle joint of each leg of the person.

Claim 9 (previously presented): The generated torque control method for a leg body exercise assistive apparatus according to claim 2, wherein the moment estimation step includes: a first step of sequentially grasping an acceleration of a predetermined region of the person or the leg body exercise assistive apparatus; a second step of sequentially grasping displacements of the hip joint, the knee joint, and the ankle joint of each leg of the person; a third step of sequentially estimating floor reaction forces acting on the person and the application point thereof, on the assumption that almost the same motion as the motion of both legs of the person is being made with the leg body exercise assistive apparatus removed from the person; a fourth step of sequentially estimating floor reaction forces acting on the leg body exercise assistive apparatus and the application point thereof, on the assumption

that the leg body exercise assistive apparatus is independently making almost the same motion as the motion of both legs of the person; a fifth step of estimating the person-side joint moment by inverse dynamics calculation processing by using the acceleration grasped in the first step, the displacements grasped in the second step, the floor reaction forces and the application point thereof estimated in the third step, and a person-side rigid link model which represents the person as a link body formed of a plurality of rigid elements and joint elements; and a sixth step of estimating the apparatus-side joint moment by inverse dynamics calculation processing by using the acceleration grasped in the first step, the displacements grasped in the second step, the floor reaction forces and the application point thereof estimated in the fourth step, and an apparatus-side rigid link model which represents the leg body exercise assistive apparatus as a link body formed of a plurality of rigid elements and joint elements.

Claim 10 (currently amended): The generated torque control method for a leg body exercise assistive apparatus according to claim 9, wherein:

the person-side joint moment estimated in the fifth step and the apparatus-side joint moment estimated in the sixth step are moments around an axis substantially perpendicular to a leg plane defined as a plane passing through the hip joint, the knee joint, and the ankle joint of each leg of the person; and

the acceleration grasped in the first step, the floor reaction forces and the application point thereof estimated in the third step, and the floor reaction forces and the application point thereof estimated in the fourth step are all three-dimensional quantities,

the displacements of the hip joint, the knee joint, and the ankle joint of each leg grasped in the second step each include an amount of rotation around an axis substantially perpendicular to the leg plane of the leg and the displacement of the hip joint is a three-dimensional quantity,

the generated torque control method further comprising:

a seventh step of sequentially grasping an acceleration of a predetermined reference point fixed to a person's predetermined region as a three-dimensional quantity by using at least the acceleration grasped in the first step;

an eighth step of sequentially grasping the positions and postures on the leg plane of the elements of each leg section of the person-side rigid link model by using at least the displacements grasped in the second step and the person-side rigid link model;

a ninth step of grasping the positions and postures on the leg plane of the elements of each leg section of the apparatus-side rigid link model by using at least the displacements grasped in the second step and the apparatus-side rigid link model, wherein:

the fifth step includes estimating the person-side joint moment by using a two-dimensional quantity, which is obtained by projecting the acceleration of the predetermined reference point grasped in the seventh step and the floor reaction forces and the application point thereof estimated in the third step onto the leg plane corresponding to each leg according to the displacement of the hip joint, and the positions and postures grasped in the eighth step; and

the sixth step includes estimating the apparatus-side joint moment by using a two-dimensional quantity, which is obtained by projecting the acceleration of the predetermined reference point grasped in the seventh step and the floor reaction forces and the application point thereof estimated in the fourth step onto the leg plane corresponding to each leg according to the displacement of the hip joint, and the positions and postures grasped in the ninth step.

Claim 11 (previously presented): The generated torque control method for a leg body exercise assistive apparatus according to claim 9, wherein the third step includes estimating the floor reaction forces acting on the person and the application

point thereof by using at least the acceleration grasped in the first step, the displacements grasped in the second step, and the person-side rigid link model and the fourth step includes estimating the floor reaction forces acting on the leg body exercise assistive apparatus and the application point thereof by using at least the acceleration grasped in the first step, the displacements grasped in the second step, and the apparatus-side rigid link model.

Claim 12 (previously presented): The generated torque control method for a leg body exercise assistive apparatus according to claim 10, wherein the third step includes estimating the floor reaction forces acting on the person and the application point thereof by using at least the acceleration grasped in the first step, the displacements grasped in the second step, and the person-side rigid link model and the fourth step includes estimating the floor reaction forces acting on the leg body exercise assistive apparatus and the application point thereof by using at least the acceleration grasped in the first step, the displacements grasped in the second step, and the apparatus-side rigid link model.